

REMARKS

Claims 1-55 are pending and claims 56-73 have been withdrawn.

Claims 1, 2, 4-13, 16-24, 27-32 and 39-45 stand rejected under 35 U.S.C. 102(b) as being anticipated by Plowman et al. (U.S. Pat. 5,654,109). The Applicant distinguished Plowman et al. (hereinafter "Plowman") on page 17 of the Response filed on December 22, 2008, but will expand upon those comments below.

Plowman discloses bilayer and trilayer composite ion exchange membranes suitable for use in a fuel cell. (Plowman, Title and Abstract). The fluoropolymer layers of the composite membranes may have different thicknesses and different equivalent weights. (Plowman, col. 3, lines 33-53). "After composite membrane preparation, conversion of the sulfonic fluoropolymer film membrane to an ionic form requires alkaline hydrolysis." (Plowman, col. 8, lines 6-8; *see also* lines 9-20). Hydrolysis may be performed using sodium hydroxide, such that "[t]he pendent group is then in the $-\text{SO}_3\text{-Na}^+$ form." (Plowman, col. 8, lines 20-23).

Although the disclosure is primarily directed to composite membrane preparation, Plowman states that "[b]oth sides of the fluoropolymer composite membrane are ordinarily in contact with an electrocatalyst layer *when utilized in a fuel cell*" (Plowman, col. 3, lines 53-55; *emphasis added*), and that "[w]hen used in a proton exchange membrane fuel cell, the pendent group is converted into the proton form." (Plowman, col. 8, lines 23-25). Plowman's statements about the condition of the membrane when used or utilized in a fuel cell should be read in light of the numerous examples included in the application.

The Examples provided by Plowman show the progression of polymer preparation, formation of polymer films, preparation of composite membranes, protonation of the composite membranes, and then application of electrodes to form a membrane and electrode assembly. (Plowman, Examples 1-32). Accordingly, sulfonic fluoropolymers prepared in Examples 1-4 are used to form polymer films in Examples 5-8. (Plowman, col. 9, lines 24-45). Examples 9-11 show the preparation of trilayer ion exchange membranes using the polymer films from

Examples 5-7 (Plowman, col. 9, lines 46-61), as well as the protonation of the subsequent membranes utilizing a two-step procedure. (Plowman, col. 9, line 62 to col. 10, line 4). The two-step protonation procedure includes using a sodium hydroxide solution to convert the membrane to the sodium ion form, and then immersing the membrane in sulfuric acid to convert the membrane to the protonated form. (Plowman, col. 9, line 62 to col. 10, line 4).

In Examples 12-14, a catalyst composition is prepared with platinum black, polytetrafluoroethylene powder, and a carbon paper support. (Plowman, col. 10, lines 13-34). Then, Examples 15-17 describes the preparation of membrane and electrode assemblies with a single layer membrane “utilizing the cast films prepared in Examples 5-7 *first protonated* in accordance with the procedure of Examples 9-11 and *then followed by the application of the anode and cathode electrodes* in accordance with the procedure described in Examples 12-14.” (Plowman, col. 10, lines 38-44). Additional Examples detail a similar procedure of *protonation* followed by *application of the anode and cathode electrodes*. (Plowman, Example 18, 19, 23, 24, 24A, 28/29, 31 and 32). The remaining Examples are directed at testing the performance of the membrane and electrode assemblies prepared in this manner.

Accordingly, the Applicant asserts that Plowman does not disclose each and every limitation of the present claims. Specifically, Plowman does not disclose the limitation of “providing a membrane and electrode assembly having *one or more electrocatalysts in intimate contact with a cation exchange membrane in an alkali metal cation form* during a period without an electrical current passing through the membrane and electrode assembly” as set out in independent claim 1. (Claim 1, *emphasis added*). Similarly, Plowman does not disclose the limitation of “providing a membrane and electrode assembly having *one or more electrocatalysts in intimate contact with a sulfonyl fluoride form of a precursor to a cation exchange membrane* during a period without an electrical current passing through the membrane and electrode assembly” as set out in independent claim 24. (Claim 24, *emphasis added*).

Regarding independent claim 13, Plowman discloses a membrane and electrode assembly having an anode and cathode in contact with a cation exchange membrane in a proton form, but the protonated membrane is wet as a result of the two-step procedure for protonating (Plowman,

col. 9, line 62 to col. 10, line 4), as well as washing and boiling in water. (Plowman, col. 10, lines 11-12). Claim 13 requires the cation exchange membrane to be in the "dry proton form." (Claim 13).

Regarding claims 9 and 44, Plowman does not disclose the limitations of claim1 and further comprising "supplying the membrane and electrode assembly with reactants; and providing an electrical current through the membrane and electrode assembly to liberate protons and convert the cation exchange membrane from the alkali metal cation form to an acidic proton form." As discussed above, Plowman does not disclose a membrane and electrode assembly (MEA) having the cation exchange membrane in the alkali metal cation form, and further does not disclose converting from the alkali metal cation form to an acidic proton form by providing an electrical current through the MEA. In a similar manner, Plowman does not disclose converting the membrane of an MEA from the sulfonyl-fluoride form to an alkali metal cation form, as set out in claim 30, or from a dry proton form to a hydrated acidic form, as set out in claims 21 and 44.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Therefore, Applicant asserts that claim 1 is not anticipated. Reconsideration and withdrawal of the rejection is requested.

Claims 3, 14, 15, 25 and 26 stand rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Plowman et al. (U.S. Pat. 5,654,109).

The Applicant reasserts the arguments made above with respect to independent claims 1, 13 and 24, and further asserts that Plowman also does not suggest the invention of the present claims. More specifically, the Applicant asserts that Plowman does not disclose or suggest an MEA that is identical to the claimed MEA, and that Plowman includes no express or inherent

disclosure of an MEA that includes an electrode in contact with a membrane in the sodium form, sulfonyl fluoride form, or dry proton form. Reconsideration and withdrawal of the rejection is requested.

Claims 33-38 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Plowman et al. (U.S. Pat. 5,654,109).

Claim 33-38 depend from claim 31, which depends from claim 30, which ultimately depends from independent claim 24. Applicant draws attention to the limitation of claim 30, including the step of “converting the cation exchange membrane from the sulfonyl-fluoride form to an alkali metal cation form.” It should be recognized that “the cation exchange membrane” finds antecedent basis in the limitation of “providing a membrane and electrode assembly having one or more electrocatalysts in intimate contact with a cation exchange membrane in a sulfonyl-fluoride form” found in claim 24. Accordingly, these claims are directed to converting a cation exchange membrane, which is in an MEA with one or more electrocatalysts in intimate contact therewith, from the sulfonyl-fluoride form to an alkali metal cation form. Plowman makes no such disclosure or suggestion, as previously discussed. Specifically, Plowman teaches the use of sodium hydroxide only in combination with subsequent protonation of the membrane and both of these steps are completed prior to the application of electrodes to the membrane. Plowman does not teach, show or suggest the invention of the present claims wherein the membrane is converted after formation of the MEA. Reconsideration and withdrawal of the rejection is requested.

Claims 46-55 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Plowman et al. (U.S. Pat. 5,654,109) in view of White (U.S. Pat. 4,311,567). The Applicant asserts that the examiner has not made out a *prima facie* case of obviousness, because neither Plowman nor White have been asserted as disclosing or suggesting the limitation of “passing electrical current through a membrane and electrode assembly having one or more electrocatalysts in intimate contact with a cation exchange membrane in a hydrated proton form; and then supplying an

alkali metal hydroxide solution to a membrane and electrode assembly under an electrical potential". (Claim 46; *emphasis added*). Plowman only discloses the use of an alkali metal hydroxide on a membrane prior to protonating the membrane and applying electrodes. Reconsideration and withdrawal of the rejection is requested.

Applicant believes this reply is fully responsive to all outstanding issues. If this is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned. In the event there are additional charges in connection with the filing of this Response, the Commissioner is hereby authorized to charge the Deposit Account No. 500714/LYNN-0127 of the firm of the below-signed attorney in the amount of any necessary fee.

Respectfully submitted,

/Jeffrey L. Streets, #37,453/

Jeffrey L. Streets
Registration No. 37,453
STREETS & STEELE
13831 Northwest Freeway, Suite 355
Houston, Texas 77040
(713) 939-9444
Attorney for Applicant

Customer No. 24945